Stanislaus River

Action	Potential Collaborators	Source
Evaluate and, if feasible, develop and implement a steelhead passage program for Tullock, Goodwin, and New Melones dams. The program should include feasibility studies, habitat evaluations, fish passage design studies, and a pilot reintroduction phase prior to implementation of the long-term reintroduction program.	NMFS, USFWS, Reclamation, CDFW, OID, TriDam	NMFS Recovery Plan
In the short term, manage releases from Tulloch, Goodwin, and New Melones dams to provide suitable water temperatures and flows for all steelhead life stages. Suitable water temperatures for the Stanislaus River are specified on page 621 of the biological opinion for the long-term operations of the CVP/SWP (NMFS 2009b). Suitable minimum instream flow schedules for the Stanislaus River are described in Appendix 2-E of the biological opinion (NMFS 2009b).	NMFS, USFWS, Reclamation, Corps, CDFW, DWR, OID, Tridam	NMFS Recovery Plan
Develop a Stanislaus River steelhead team to help guide collection and evaluation of baseline data to help address hypotheses for why resident O.mykiss are more abundant than anadromous O.mykiss in the Stanislaus River. This information could be used to identify the flow and water temperature conditions that are most beneficial to anadromous O. mykiss.	NMFS, FWS, Reclamation, CDFW	NMFS Recovery Plan
Continue to implement projects to increase the availability and quality of spawning and rearing habitat in the Stanislaus River.	NMFS, USFWS, Reclamation, CDFW, DWR	NMFS Recovery Plan
Evaluate whether pulse flows in the Stanislaus River are beneficial to adult steelhead immigration and juvenile steelhead emigration; if pulse flows are determined to be effective, implement the most beneficial pulse flow regime.	NMFS, USFWS, Reclamation, CDFW, DWR, Stanislaus River Fish Group	NMFS Recovery Plan
Work with State and Federal water acquisition programs to dedicate instream water in the Stanislaus River.	NMFS, USFWS, Reclamation, CDFW, DWR, Stanislaus River Fish Group	NMFS Recovery Plan
Negotiate agreements with landowners, water districts, and Federal and State agencies to provide additional instream flows or purchase water rights in the Stanislaus River.	NMFS, USFWS, Reclamation, Corps, Resource Conservation Districts, CDFW, DWR, Water districts, Landowners, Local governments, NGOs	NMFS Recovery Plan
Utilize the State Water Resources Control Board regulatory process of updating the 2006 Water Quality Control Plan for the Bay-Delta to improve flow conditions for steelhead in the Stanislaus River.	NMFS	NMFS Recovery Plan
Identify and implement floodplain and side channel projects to improve river function and increase habitat diversity in the Stanislaus River.	NMFS, USFWS, Reclamation, Corps, CDFW, DWR	NMFS Recovery Plan
Work with local land owners to restore riparian habitats along the Stanislaus River.	NMFS, USFWS, Reclamation, CDFW, DWR, Stanislaus River Fish Group	NMFS Recovery Plan

Permanently protect riparian habitat along the Stanislaus River through easements and/or land acquisition.	NMFS, USFWS, Reclamation, Corps, Resource Conservation Districts, CDFW, DWR, Water districts, Landowners, Local governments, NGOs	NMFS Recovery Plan
Monitor and evaluate the impact of the sport fishery on Stanislaus River steelhead to ensure the regulations are consistent with steelhead recovery, and work with the Fish and Game Commission to modify the regulations as needed.	NMFS, CDFW	NMFS Recovery Plan
Increase monitoring and enforcement in order to minimize steelhead poaching in the Stanislaus River.	NMFS, CDFW	NMFS Recovery Plan
Implement outreach projects in the Stanislaus River to educate the public regarding the steelhead life cycle including how to identify steelhead redds. Encourage voluntary landowner participation in the Stanislaus River in educational opportunities such as water quality short courses, field demonstrations and distribution of water quality "Fact Sheets".	NMFS, USFWS, Reclamation, CDFW, DWR, Stanislaus River Fish Group	NMFS Recovery Plan
Evaluate programs and measures designed to minimize predation in the Stanislaus River.	NMFS, USFWS, CDFW, DWR, Stanislaus River Fish Group, OID	NMFS Recovery Plan
Implement projects to minimize predation in the Stanislaus River at mine pits and at deep pools caused by bank stabilization projects.	NMFS, USFWS, CDFW, DWR, Stanislaus River Fish Group	NMFS Recovery Plan
Implement projects to increase instream habitat complexity and predator refuge cover in the Stanislaus River, including the addition of large woody material.	NMFS, USFWS, CDFW, DWR, Stanislaus River Fish Group	NMFS Recovery Plan
Develop a baseline monitoring program for the Stanislaus River to evaluate water quality throughout the watershed to identify areas of concern.	NMFS, USWFS, EPA, Resource Conservation Districts, CDFW, DWR, SWRCB, DHS, Stanislaus River Fish Group	NMFS Recovery Plan
Pursue grant funding or cost-share payments for landowners to inventory, prepare plans and implement best-management practices that reduce water quality impacts in the Stanislaus River.	NMFS, USFWS, USFS, EPA, Resource Conservation Districts, CDFW, DWR, Landowners	NMFS Recovery Plan
Increase monitoring and enforcement in the Stanislaus River to ensure that the water quality criteria established in the Central Valley Water Quality Control Plan (Basin Plan) are met for all potential pollutants.	SWRCB, RWQCBs, Local agriculture groups	NMFS Recovery Plan
Complete Total Maximum Daily Load projects for all Clean Water Act Section 303(d) listed pollutants entering the Stanislaus River.	EPA, 'SWRCB, RWQCBs, Local agriculture groups	NMFS Recovery Plan
Evaluate Stanislaus River O.mykiss genetics to inform management in the anadromous reach as well as planning for potential reintroductions to the upper river.	NMFS	NMFS Recovery Plan

Develop an entrainment monitoring program in the Stanislaus River to determine the level of take at individual diversions. Prioritize diversions based on this monitoring program and screen those that are determined to have substantial impacts.	NMFS, USFWS, CDFW	NMFS Recovery Plan
Implement the Stanislaus River flow schedule: Manage flows to benefit all life stages of chinook salmon.	NMFS, USFWS, USBR, CDFW, Tri-Dam	Working Paper vol. 1
Operate New Melones, Tulloch, and Goodwin reservoirs to maintain water temperatures at 56°F between October 15 and February 15 and at 65°F between April 1 and May 31: Maintain water temperature within ranges suitable for chinook salmon spawning, incubation, rearing, and outmigration	NMFS, USFWS, USBR, CDFW,	Working Paper vol. 1
Restore and protect instream and riparian habitat: Ensure the long-term sustainability of physical, chemical, and biological conditions needed to meet production goals for chinook salmon through restoration and protection of the stream ecosystem.	NMFS, USFWS, USBR, CDFW, Tri-Dam	Working Paper vol. 1
Reduce impacts of rapid flow fluctuations: Increase hatching success and juvenile survival by reducing flow fluctuation rates resulting from peaking power and other reservoir operations.	NMFS, USFWS, USBR, CDFW, Tri-Dam	Working Paper vol. 1
Install and maintain fish protection devices at riparian pumps and diversions: Reduce or eliminate loss juvenile chinook salmon due to entrainment by pumps and diversions.	NMFS, USFWS, USBR, CDFW, Tri-Dam	Working Paper vol. 1
Provide additional law enforcement for illegal take of salmon, stream alterations, water pollution and to ensure adequate screening of pumps and diversions: Increase spawning success, reduce entrainment, improve water quality, and prevent additional destruction of stream habitat.	NMFS, CDFW	Working Paper vol. 1
Remove or modify of Old Melones Dam: Reduce fall water temperatures in the Stanislaus River.	NMFS, USFWS, USBR, CDFW, Tri-Dam	Working Paper vol. 1
Provide fish passage around reservoirs: Increase production and minimize impacts of anadromous fish restoration on water interests by providing access to additional spawning and rearing habitat upstream of reservoirs.	NMFS, USFWS, USBR, CDFW, Tri-Dam	Working Paper vol. 1
Implement an interim river regulation plan that meets the following flow schedule by supplementing the 1987 agreement between USBR and CDFG, through reoperation of New Melones Dam, use of (b)(2) water, and acquisition of water from willing sellers as needed.	NMFS, USFWS, USBR, CDFW, Tri-Dam	Final Restoration Plan
Improve watershed management to restore and protect instream and riparian habitat, including consideration of restoring and replenishing spawning gravel.	NMFS, USFWS, USBR, CDFW, Tri-Dam	Final Restoration Plan

Screen all diversions to protect all life history stages of anadromous fish.	NMFS, USFWS, USBR, CDFW, Tri-Dam	Final Restoration Plan
Identify and implement actions to provide suitable water temperatures for all life stages of chinook salmon, consistent with efforts to maintain adequate flows to provide fish habitat. Establish maximum temperature objectives of 56 F from October 15 to February 15 for incubation and 65 F from April 1 to May 31 for juvenile rearing and emigration.	NMFS, USFWS, USBR, CDFW, Tri-Dam	Final Restoration Plan
Evaluate and implement actions to reduce predation on juvenile chinook salmon, including actions to isolate ponded sections of the river.	NMFS, USFWS, USBR, CDFW, Tri-Dam	Final Restoration Plan
Evaluate and refine a river regulation plan that provides adequate flows to protect all life stages of anadromous fish based on water storage at New Melones Reservoir, predicted hydrologic conditions, and current aquatic habitat conditions	NMFS, USFWS, USBR, CDFW, Tri-Dam	Final Restoration Plan
Develop a carryover storage target for New Melones Reservoir to ensure Vernalis flow standards are met during the 30-day pulse flow period during the third year of a dry or critical period. This will protect at least one of three year classes of chinook salmon during emigration.	NMFS, USFWS, USBR, CDFW, Tri-Dam	Final Restoration Plan
Evaluate use of the Stanislaus River by American shad and consider increasing flows and maintaining mean daily water temperatures between 61 F and 65 F from April to June when hydrologic conditions are adequate to minimize adverse effects to water supply operations and in a manner consistent with actions to protect chinook salmon	NMFS, USFWS, USBR, CDFW, Tri-Dam	Final Restoration Plan
Evaluate fall pulse flows for attraction and passage benefits to chinook salmon and steelhead.	NMFS, USFWS, USBR, CDFW, Tri-Dam	Final Restoration Plan
Determine adult escapement rates relative to life stage at emigration	NMFS, USFWS, USBR, CDFW, Tri-Dam	A Plan to Restore Anadromous Salmonid Habitat in the Lower Stanislaus River
Quantify Discharge to Habitat Relationships for Anadromous Juvenile Salmonids (USBR Study)	NMFS, USFWS, USBR, CDFW, Tri-Dam	A Plan to Restore Anadromous Salmonid Habitat in the Lower Stanislaus River
Conduct habitat survey of the lower Stanislaus River (habitat types, LWD, shade, substrate, riparian type/quantity, invasive spp.)	NMFS, USFWS, USBR, CDFW, Tri-Dam	A Plan to Restore Anadromous Salmonid Habitat in the Lower Stanislaus River

Investigate effects of floodplain inundation on food productivity	NMFS, USFWS, USBR, CDFW, Tri-Dam	A Plan to Restore Anadromous Salmonid Habitat in the Lower Stanislaus River
Evaluate food density, abundance, and sources (by season and water year type)	NMFS, USFWS, USBR, CDFW, Tri-Dam	A Plan to Restore Anadromous Salmonid Habitat in the Lower Stanislaus River
Investigate effects of gravel augmentation on food productivity	NMFS, USFWS, USBR, CDFW, Tri-Dam	A Plan to Restore Anadromous Salmonid Habitat in the Lower Stanislaus River
Quantify predation by habitat type: mine pits, dredged channels, and unaltered channels	NMFS, USFWS, USBR, CDFW, Tri-Dam	A Plan to Restore Anadromous Salmonid Habitat in the Lower Stanislaus River
Quantify predation relative to flow, water temperature, turbidity, and timing	NMFS, USFWS, USBR, CDFW, Tri-Dam	A Plan to Restore Anadromous Salmonid Habitat in the Lower Stanislaus River
Quantify Chinook fry survival relative to flow at emigration	NMFS, USFWS, USBR, CDFW, Tri-Dam	A Plan to Restore Anadromous Salmonid Habitat in the Lower Stanislaus River
Quantify juvenile *O. mykiss* survival relative to flow at emigration	NMFS, USFWS, USBR, CDFW, Tri-Dam	A Plan to Restore Anadromous Salmonid Habitat in the Lower Stanislaus River
Quantify effects of short pulse flows in spring on fall-run fry survival at emigration	NMFS, USFWS, USBR, CDFW, Tri-Dam	A Plan to Restore Anadromous Salmonid Habitat in the Lower Stanislaus River
Quantify juvenile salmonid mortality relative to entrainment (diversions, mine pits)	NMFS, USFWS, USBR, CDFW, Tri-Dam	A Plan to Restore Anadromous Salmonid Habitat in the Lower Stanislaus River
Identify existing capacity by reach for rearing Chinook habitat (in winter/summer)	NMFS, USFWS, USBR, CDFW, Tri-Dam	A Plan to Restore Anadromous Salmonid Habitat in the Lower Stanislaus River
Quantify juvenile Chinook mortality due to predation by species of predator	NMFS, USFWS, USBR, CDFW, Tri-Dam	A Plan to Restore Anadromous Salmonid Habitat in the Lower Stanislaus River

Quantify juvenile salmonid mortality relative to disease	NMFS, USFWS, USBR, CDFW, Tri-Dam	A Plan to Restore Anadromous Salmonid Habitat in the Lower Stanislaus River
Quantify adult salmonid mortality relative to disease	NMFS, USFWS, USBR, CDFW, Tri-Dam	A Plan to Restore Anadromous Salmonid Habitat in the Lower Stanislaus River
Quantify juvenile salmon and trout entrainment in unscreened irrigation diversions	NMFS, USFWS, USBR, CDFW, Tri-Dam	A Plan to Restore Anadromous Salmonid Habitat in the Lower Stanislaus River
Quantify out-of-basin hatchery stray rates	NMFS, USFWS, USBR, CDFW, Tri-Dam	A Plan to Restore Anadromous Salmonid Habitat in the Lower Stanislaus River
Restore channel structure: Knights Ferry to Orange Blossom Bridge	NMFS, USFWS, USBR, CDFW, Tri-Dam	A Plan to Restore Anadromous Salmonid Habitat in the Lower Stanislaus River
Restore floodplain habitat: Knights Ferry to Orange Blossom Bridge	NMFS, USFWS, USBR, CDFW, Tri-Dam	A Plan to Restore Anadromous Salmonid Habitat in the Lower Stanislaus River
Restore channel structure: Goodwin Canyon	NMFS, USFWS, USBR, CDFW, Tri-Dam	A Plan to Restore Anadromous Salmonid Habitat in the Lower Stanislaus River
Restore floodplain habitat: Orange Blossom Bridge to Oakdale Recreation Area	NMFS, USFWS, USBR, CDFW, Tri-Dam	A Plan to Restore Anadromous Salmonid Habitat in the Lower Stanislaus River
Restore channel structure: Orange Blossom Bridge to Oakdale Recreation Area	NMFS, USFWS, USBR, CDFW, Tri-Dam	A Plan to Restore Anadromous Salmonid Habitat in the Lower Stanislaus River
Add gravel to reconstruct habitat: Knights Ferry to Orange Blossom Bridge	NMFS, USFWS, USBR, CDFW, Tri-Dam	A Plan to Restore Anadromous Salmonid Habitat in the Lower Stanislaus River
Add gravel to reconstruct habitat: Goodwin Canyon	NMFS, USFWS, USBR, CDFW, Tri-Dam	A Plan to Restore Anadromous Salmonid Habitat in the Lower Stanislaus River

Add gravel to reconstruct habitat: Orange Blossom Bridge to Oakdale Recreation Area	NMFS, USFWS, USBR, CDFW, Tri-Dam	A Plan to Restore Anadromous Salmonid Habitat in the Lower Stanislaus River
Install screens at diversions in Stanislaus River and San Joaquin River	NMFS, USFWS, USBR, CDFW, Tri-Dam	A Plan to Restore Anadromous Salmonid Habitat in the Lower Stanislaus River
Redistribute water allocation (February to June) to improve fall-run Chinook salmon fry survival through the river	NMFS, USFWS, USBR, CDFW, Tri-Dam	A Plan to Restore Anadromous Salmonid Habitat in the Lower Stanislaus River
Physically isolate spring-run Chinook salmon in lower River (i.e., test barrier to fall-run in Goodwin Canyon)	NMFS, USFWS, USBR, CDFW, Tri-Dam	A Plan to Restore Anadromous Salmonid Habitat in the Lower Stanislaus River
Develop and implement a continuing program for the purpose of restoring and replenishing, as needed, spawning gravel lost due to the construction and operation of Central Valley Project dams, bank protection projects, and other actions that have reduced the availability of spawning gravel and rearing habitat in the Upper Sacramento River from Keswick Dam to Red Bluff Diversion Dam in the American and Stanislaus Rivers downstream from the Nimbus and Goodwin Dams, respectively. The program shall include preventive measures, such as re-establishment of meander belts and limitations on future bank protection activities, in order to avoid further losses of instream and riparian habitat. Costs associated with implementation of this paragraph shall be reimbursed in accordance with the following formula: 37.5 percent shall be reimbursed as main project features, 37.5 percent shall be considered a nonreimbursable Federal expenditure, and 25 percent shall be paid by the State of California.	NMFS, USFWS, USBR, CDFW, Tri-Dam	CVPIA 3406(b)(13)
Evaluate a Temperature Control Device for improved management of New Melones Reservoir's cold water pool and better control over the temperature of water released downstream.	NMFS, USFWS, USBR, CDFW, Tri-Dam	Scientific Evaluation Process

Tuolumne River

Action	Potential Collaborators	Source
Evaluate and, if feasible, develop and implement a steelhead and spring-run Chinook salmon passage program for La Grange and Don Pedro dams. The program should include feasibility studies, habitat evaluations, fish passage design studies, and a pilot reintroduction phase prior to implementation of the long-term reintroduction program.	NMFS, USFWS, CDFW, Modesto Irrigation District, Turlock Irrigation District, FERC	NMFS Recovery Plan

Manage releases from La Grange and Don Pedro dams to provide suitable flows and water temperatures for all downstream life stages of steelhead.	NMFS, USFWS, CDFW, Modesto Irrigation District, Turlock Irrigation District, FERC	NMFS Recovery Plan
Develop a Tuolumne River steelhead team to help guide collection and evaluation of baseline data to help address hypotheses for why resident O.mykiss are more abundant than anadromous O.mykiss in the Tuolumne River. This information could be used to identify the flow and water temperature conditions that are most beneficial to anadromous O. mykiss.	USFWS, CDFW, NMFS	NMFS Recovery Plan
Evaluate whether pulse flows in the Tuolumne River are beneficial to adult steelhead immigration and juvenile steelhead emigration; if pulse flows are determined to be effective, implement the most beneficial pulse flow regime.	NMFS, USFWS, Reclamation, FERC, CDFW, DWR, Modesto and Turlock Irrigation Districts	NMFS Recovery Plan
Continue to implement projects to increase the availability and quality of spawning and rearing habitat in the Tuolumne River.	NMFS, USFWS, Reclamation, FERC, CDFW, DWR, Modesto and Turlock Irrigation Districts	NMFS Recovery Plan
Evaluate the feasibility of moving water diversions lower in the Tuolumne River in order to provide higher flows in the upstream reaches. If feasible and cost effective, move water diversions lower in the Tuolumne River.	NMFS, USFWS, Reclamation, CDFW, DWR, Modesto and Turlock Irrigation Districts	NMFS Recovery Plan
Develop and implement flow fluctuation criteria for the Tuolumne River that are protective of anadromous fishes.	NMFS, USFWS, Reclamation, Corps, FERC, CDFW, DWR, Modesto and Turlock Irrigation Districts	NMFS Recovery Plan
Work with State and Federal water acquisition programs to dedicate instream water in the Tuolumne River.	NMFS, USFWS, Reclamation, CDFW, DWR, Modesto and Turlock Irrigation Districts	NMFS Recovery Plan
Evaluate modifying current operation plans (e.g., flood control curves) for Don Pedro with the Army Corps of Engineers and irrigation districts to reallocate instream flows for salmonids.	NMFS, USFWS, Corps, FERC, CDFW, DWR, Modesto and Turlock Irrigation Districts	NMFS Recovery Plan
Identify and implement floodplain and side channel projects to improve river function and increase habitat diversity in the Tuolumne River.	NMFS, USFWS, FERC, CDFW, DWR, Modesto Irrigation District, Turlock Irrigation District	NMFS Recovery Plan
Worth with the State Water Resources Control Board to update the 2006 Water Quality Control Plan for the Bay-Delta in order to improve flow conditions for steelhead in the Tuolumne River.	NMFS, USFWS, CDFW, Modesto Irrigation District, Turlock Irrigation District	NMFS Recovery Plan
Work with the Army Corps of Engineers and the Central Valley Flood Protection Board to restore riparian habitat to promote shading and habitat diversity in the Tuolumne River.	Corps, CDFW, DWR	NMFS Recovery Plan
Implement projects to minimize predation at weirs, diversion dams, and related structures in the Tuolumne River.	NMFS, USFWS, CDFW, DWR, USFWS, Modesto and Turlock Irrigation Districts	NMFS Recovery Plan

Improve instream refuge cover for salmonids in the Tuolumne River to minimize predatory opportunities for striped bass and other non-native predators.	NMFS, USFWS, FERC, CDFW, DWR	NMFS Recovery Plan
Develop a baseline monitoring program for the Tuolumne River to evaluate water quality throughout the watershed to identify pollutants to be included on the Clean Water Act section 303(d) list.	SWRCB, CVRWQCB	NMFS Recovery Plan
Complete Total Maximum Daily Load projects for all Clean Water Act Section 303(d) listed pollutants entering the Tuolumne River.	SWRCB, CVRWQCB	NMFS Recovery Plan
Encourage voluntary landowner participation in the Tuolumne River watershed in educational opportunities such as water quality short courses, field demonstrations and distribution of water quality "Fact Sheets".	NMFS, USFWS, USFS, EPA, Resource Conservation Districts, CDFW, DWR, Landowners	NMFS Recovery Plan
Pursue grant funding or cost-share payments for landowners to inventory, prepare plans and implement best-management practices that reduce water quality impacts in the Tuolumne River.	NMFS, USFWS, EPA, Resource Conservation Districts, CDFW, DWR, SWRCB, DHS	NMFS Recovery Plan
Increase monitoring and enforcement in the Tuolumne River to ensure that the water quality criteria established in the Central Valley Water Quality Control Plan (Basin Plan) are met for all potential pollutants excluding water temperature.	SWRCB, CVRWQCB, Local agriculture groups	NMFS Recovery Plan
Evaluate Tuolumne River O.mykiss genetics to inform management in the anadromous reach as well as planning for potential reintroductions to the upper river.	NMFS, USFWS, FERC, CDFW, Modesto and Turlock Irrigation Districts	NMFS Recovery Plan
Prioritize lower Tuolumne River diversions based on their level of entrainment and screen those with the highest benefit to cost ratio	NMFS, USFWS, CDFW, DWR	NMFS Recovery Plan
Implement a flow schedule as specified in the terms of the FERC order resulting from the New Don Pedro Project (FERC Proceeding P-2299-024). Supplement FERC agreement flows with water acquired from willing sellers consistent with applicable guidelines or negotiate agreements as needed to improve conditions for all life history stages of chinook salmon.	City and County of San Francisco, Turlock Irrigation District (TID), Modesto Irrigation District (MID), Lower Tuolumne River Technical Advisory Committee (LTTAC), FERC, USFWS, USBR	Final Restoration Plan (USFWS 2001)
Improve watershed management and restore and protect instream and riparian habitat, including consideration of restoring and replenishing spawning gravel and performing an integrated evaluation of biological and geomorphic processes.	Landowners, NRCS, CDFW, USFWS, USBR, LTTAC, FERC, NMFS	Final Restoration Plan (USFWS 2001)
Screen all diversions to protect all life history stages of anadromous fish.	Diverters, LTTAC, CDFW, CDWR, NMFS, USFWS, USBR	Final Restoration Plan (USFWS 2001)
Support the Tuolumne River Interpretive Center.	CDFW, LTTAC	Final Restoration Plan (USFWS 2001)

Establish a streamwatch program to increase public participation in river management.	Public, LTTAC, CDFW, USFWS	Final Restoration Plan (USFWS 2001)
Coordinate the AFRP with appropriate activities supported by the Riparian and Recreation Improvement fund that was established by the New Don Pedro Settlement Agreement.	LLTAC, USFWS, USBR, FERC	Final Restoration Plan (USFWS 2001)
Identify and implement actions to provide suitable water temperatures for all life stages of chinook salmon; establish maximum temperature objectives of 56°F from October 15 to February 15 for incubation and 65°F from April 1 to May 31 for juvenile emigration.	Dam operators, CDFW,USFWS, USBR, LTTAC, FERC	Final Restoration Plan (USFWS 2001)
Evaluate and implement actions to reduce predation on juvenile chinook salmon, including actions to isolate ponded sections of the river.	TID, MID, LTTAC, CDFW, USFWS, USBR, FERC	Final Restoration Plan (USFWS 2001)
Evaluate the effects of flow fluctuations established by the guidelines of the FERC Settlement Agreement on spawning, incubation, and rearing of chinook salmon, and if substantial adverse effects are indicated, modify guidelines to reduce effects.	Diverters, Hydropower operators, LTTAC, CDFW, USFWS, USBR, FERC	Final Restoration Plan (USFWS 2001)
Evaluate fall pulse flows for attraction and passage benefits to chinook salmon and steelhead.	Diverters, Hydropower operators, LTTAC, CDFG, USFWS, USBR, FERC	Final Restoration Plan (USFWS 2001)

Merced River

Action	Potential Collaborators	Source
Develop and implement a program to reestablish steelhead in historic habitat upstream of Crocker-Huffman, Merced Falls, McSwain, and New Exchequer dams. The program should include feasibility studies, habitat evaluations, fish passage design studies, and a pilot reintroduction phase prior to implementation of the long-term program.	NMFS, USFWS, Reclamation, FERC, CDFW, DWR, Merced Irrigation District, PG&E	NMFS Recovery Plan
Manage releases from New Exchequer Reservoir in order to provide the most beneficial flow and water temperatures for all steelhead life stages.	NMFS, USFWS, Reclamation, CDFW, DWR	NMFS Recovery Plan
Supplement flows provided pursuant to the Davis-Grunsky Contract and FERC License Number 2179 with water acquired from willing land owners and water districts to provide additional instream flow.	NMFS, USFWS, Reclamation, CDFW, DWR	NMFS Recovery Plan
Develop a Merced River steelhead team to help guide collection and evaluation of baseline data to help address hypotheses for why resident O.mykiss are more abundant than anadromous O.mykiss in the Merced River. This information could be used to identify the flow and water temperature conditions that are most beneficial to anadromous O. mykiss.	NMFS, USFWS, CDFW, DWR	NMFS Recovery Plan
Evaluate whether pulse flows in the Merced River are beneficial to adult steelhead immigration and juvenile steelhead emigration; if pulse flows are determined to be effective, implement the most beneficial pulse flow regime.	NMFS, USFWS, Merced Irrigation District, FERC, CDFW, DWR	NMFS Recovery Plan
Identify and implement floodplain and side channel projects to improve river function and increase habitat diversity in the Merced River.	NMFS, USFWS, Merced Irrigation District, FERC, CDFW, DWR	NMFS Recovery Plan
Develop and implement a long-term gravel management plan to increase and maintain steelhead spawning habitat downstream of Crocker-Huffman, Merced Falls, and New Exchequer dams.	NMFS, USFWS, Reclamation, FERC, CDFW, DWR, Merced Irrigation District, PG&E	NMFS Recovery Plan
Prioritize Merced River diversions based on their level of entrainment and screen those with the highest benefit to cost ratio.	NMFS, USFWS, Reclamation, CDFW, DWR, Merced Irrigation District	NMFS Recovery Plan
Work with water rights holders and other stakeholders in the Merced River watershed to achieve steelhead and water management goals.	NMFS, USFWS, Reclamation, Corps, CDFW, DWR, NRCS, Family Water Alliance, Merced Irrigation District	NMFS Recovery Plan
Develop and implement ramping rate criteria for the Merced River that are protective of anadromous fishes.	NMFS, USFWS, Reclamation, Corps, CDFW, DWR	NMFS Recovery Plan
Continue to supply spawning-sized gravel to landowners for construction of wing dam diversion structures in the Merced River; implement the Gravel Mining Reach Phase II projects.	NMFS, USFWS, Reclamation, CDFW, DWR	NMFS Recovery Plan
Evaluate the potential benefits and feasibility of installing a water temperature control device on New Exchequer Dam in order to most efficiently utilize the volume of cold water in the reservoir.	NMFS, USFWS, Reclamation, FERC, CDFW, DWR, Merced Irrigation District	NMFS Recovery Plan

Federal, State, and local agencies should use their authorities to develop and implement programs and projects that focus on retaining, restoring and creating riparian corridors within their jurisdiction in the Merced River watershed.	USFWS, Corps, CDFW, DWR, CDPR, Local agencies, NGOs	NMFS Recovery Plan
Permanently protect Merced River riparian habitat through easements and/or land acquisition	NMFS, USFWS, CDFW, DWR, landowners, Resource Conservation Districts	NMFS Recovery Plan
Increase monitoring and enforcement of illegal rip rap applications in the Merced River.	Corps, SWRCB	NMFS Recovery Plan
Implement studies designed to quantify the impact of predation on steelhead in the Merced River. If the studies identify predator species and/or locations contributing to low steelhead survival, then evaluate whether predator control actions (e.g., fishery management or directed removal programs) can be effective at minimizing predation on steelhead in the Merced River; continue implementation if effective.	NMFS, USFWS, CDFW, DWR	NMFS Recovery Plan
Implement programs and measures designed to control predation in the Merced River, including actions to isolate "ponded" sections of the river.	NMFS, USFWS, CDFW, DWR	NMFS Recovery Plan
Minimize losses of habitat by instream habitat improvements and elimination of man-made factors that kill juvenile fish	NMFS, USFWS, CDFW, DWR, Merced ID	Restoring the Balance (CACSST, 1988)
Mitigate lost access above Crocker Huffman Dam on Merced (fish passage)	NMFS, USFWS, FERC, CDFW, Merced ID, PG&E	Central Valley Salmon and Steelhead Restoration and Enhancement Plan (CDFG, 1990)
Screen irrigation diversions/pumps	NMFS, USFWS, Reclamation, CDFW, DWR, Merced ID, landowners, Resource Conservation Districts	Central Valley Salmon and Steelhead Restoration and Enhancement Plan (CDFG, 1990)
Provide April and May "pulse flows'		Central Valley Salmon and Steelhead Restoration and Enhancement Plan (CDFG, 1990)
Construct gravel restoration projects (supplementation and flow) between Crocker Huffman and Cressy		Central Valley Salmon and Steelhead Restoration and Enhancement Plan (CDFG, 1990)
Improve juvenile salmon passage on 6 riparian diversions below Crocker Huffman	ID, landowners, Resource Conservation Districts	Central Valley Salmon and Steelhead Restoration and Enhancement Plan (CDFG, 1990)
Upgrade screens (4) and upgrade fish passage (2) on riparian diversion	ID, landowners, Resource Conservation Districts	Restoring Central Valley Streams (CDFG 1993)
Restore instream habitat for migration, spawning, and habitat rehabilitation of riffle areas, repair/construct levees and channels, and isolate pit mining areas		Restoring Central Valley Streams (CDFG 1993)
Provide flows with temp/flow standards & fishways on unladdered dams to allow access to tailwaters	FERC	Steelhead Restoration and Management Plan for California (CDFG, 1996)

Establish a salmon and steelhead hatchery to provide 20,000 yearling steelhead		Steelhead Restoration and Management Plan for California (CDFG, 1996)

	NMFS, USFWS, FERC, CDFW, Merced ID	
Supplement flows provided pursuant to the Davis-Grunsky Contract Number D-GGR17 and FERC License Number 2179 with water acquired from willing sellers consistent with applicable guidelines or negotiate agreements as needed to improve conditions for all life history stages of chinook salmon.	Merced Irrigation District (MID), Diverters, CDFW, CDWR, USFWS, USBR	Final Restoration Plan (USFWS 2001)
Reduce adverse effects of rapid flow fluctuations.	MID, CDFW, USFWS, USBR, FERC	Final Restoration Plan (USFWS 2001)
Improve watershed management to restore and protect instream and riparian habitat, including consideration of restoring and replenishing spawning gravel.	Landowners, Merced County, NRCS, CDFW, USFWS, USBR, FERC	Final Restoration Plan (USFWS 2001)
Screen all diversions to protect all life history stages of anadromous fish.	Diverters, USFWS, USBR, NMFS, CDFW, CDWR	Final Restoration Plan (USFWS 2001)
Establish a streamwatch program to increase public participation in river management.	Public, CDFW, USFWS	Final Restoration Plan (USFWS 2001)
Identify and implement actions to provide suitable water temperatures for all life stages of chinook salmon; establish maximum temperature objectives of 56°F from October 15 to February 15 for incubation and 65°F from April 1 to May 31 for juvenile emigration.	Dam operators, CDFW, USFWS, USBR, FERC	Final Restoration Plan (USFWS 2001)
Evaluate and implement actions to reduce predation on juvenile chinook salmon, including actions to isolate ponded sections of the river.	CDFW, USFWS, USBR, FERC	Final Restoration Plan (USFWS 2001)
Evaluate fall pulse flows for attraction and passage benefits to chinook salmon and steelhead.	Dam operators, CDFW, USFWS, USBR, FERC	Final Restoration Plan (USFWS 2001)

San Joaquin River

Action	Potential Collaborators	Source
Implement the Exhibit B hydrographs providing interim and restoration flows as outlined in the San Joaquin River Stipulation of Settlement (available at http://www.restoresjr.net/).	NMFS, USFWS, Reclamation, CDFW, DWR	NMFS Recovery Plan
Develop and implement a spring-run Chinook salmon reintroduction strategy as outlined in paragraph 14 of the San Joaquin River Stipulation of Settlement (available at http://www.restoresjr.net/).	NMFS, USFWS, Reclamation, CDFW, DWR	NMFS Recovery Plan
Implement channel modifications as outlined in the San Joaquin River Stipulation of Settlement, including increasing the channel capacity to accommodate restoration flows up to 4,500 cfs (available at http://restoresjr.net/).	NMFS, USFWS, Reclamation, CDFW, DWR	NMFS Recovery Plan
Minimize entrainment and fish losses to both adult and juvenile life stages to non-viable migration pathways as outlined in the San Joaquin River Stipulation of Settlement, including, placing temporary barriers at Mud and Salt Sloughs and other potential sources of adult entrainment, screening Arroyo Canal and other riparian diversions as they are identified, and modifying and screening the Chowchilla Bypass Bifurcation Structure (available at http://www.restoresjr.net/).	NMFS, USFWS, Reclamation, CDFW, DWR	NMFS Recovery Plan
Provide fish passage at existing structures as outlined in the San Joaquin River Stipulation of Settlement (available at http://restoresjr.net/) including: (1) modifications to the Sand Slough Control Structure; (2) modification of the Reach 4B head gate; (3) reconstruction of Sack Dam to ensure unimpeded fish passage; (4) construction of a Mendota Pool Bypass; (5) modifications to structures in the Eastside and Mariposa Bypasses channels; and (6) fixing other passage impediments including road crossings, drop structures, and others as identified in the DWR Passage Report (DWR 2012) for the San Joaquin River Restoration Area.	NMFS, USFWS, Reclamation, CDFW, DWR	NMFS Recovery Plan
Manage juvenile salmonid predation risk by filling and/or isolating high priority gravel pits as identified in paragraph 11(b) of the San Joaquin River Stipulation of Settlement (available at http://www.restoresjr.net/).	NMFS, USFWS, Reclamation, CDFW, DWR	NMFS Recovery Plan
Develop and implement an ecologically based San Joaquin River flow regime to help restore natural river processes and support all life stages of steelhead and spring-run Chinook salmon (Poff *et al.*1997).	NMFS, USFWS, Reclamation, CDFW, DWR, SWRCB	NMFS Recovery Plan
Implement projects that improve wastewater and stormwater treatment in residential, commercial, and industrial areas throughout the San Joaquin River watershed to ensure that the water quality criteria established in the Central Valley Water Quality Control Plan (Basin Plan) are met for all potential pollutants.	NMFS, USFWS, CDFW, DWR, SWRCB, DHS, Local governments	NMFS Recovery Plan
Develop a long-term strategy for monitoring and regulating discharges from agricultural lands in the San Joaquin River basin to ensure that the water quality criteria established in the Central Valley Water Quality Control Plan (Basin Plan) are met for all potential pollutants.	SWRCB	NMFS Recovery Plan
Complete Total Maximum Daily Load projects for all Clean Water Act Section 303(d) listed pollutants entering the San Joaquin River.	SWRCB	NMFS Recovery Plan

Develop and implement a spawning gravel augmentation plan in the San Joaquin River.	NMFS, USFWS, Reclamation, CDFW, DWR	NMFS Recovery Plan
Develop and implement a program to reestablish steelhead upstream of Friant Dam. The program should include feasibility studies, habitat evaluations, fish passage design studies, and a pilot phase prior to implementation of the long-term program.	NMFS, USFWS, Reclamation, CDFW, DWR	NMFS Recovery Plan
Pursue grant funding or cost-share payments for landowners to inventory, prepare plans and implement best-management practices that reduce water quality impacts in the San Joaquin River.	NMFS, USFWS, USFS, EPA, Resource Conservation Districts, CDFW, DWR, SWRCB, DHS, Landowners	NMFS Recovery Plan
Develop education and outreach programs and coordinate with local governments, communities, and conservation districts to encourage river stewardship in the San Joaquin River basin.	NMFS, USFWS, USFS, EPA, Resource Conservation Districts, CDFW, DWR, SWRCB, DHS	NMFS Recovery Plan
Permanently protect San Joaquin River riparian and floodplain habitat through easements and/or land acquisition.	NMFS, USFWS, Reclamation, CDFW, DWR	NMFS Recovery Plan
Implement projects to protect and restore riparian and floodplain habitats along the San Joaquin River, such as projects underway at the San Joaquin River National Wildlife Refuge to restore riparian habitat, expand the refuge, and breach deauthorized levees in order to increase floodplain habitat.		NMFS Recovery Plan
Coordinate with county and other local planning processes to encourage protection of floodplain habitat along the San Joaquin River.	NMFS, USFWS, Corps, CDFW, DWR, DPC, Local governments	NMFS Recovery Plan
Increase monitoring and enforcement of illegal stream bank alterations and monitor permitted alterations in the San Joaquin River.	Corps, SWRCB	NMFS Recovery Plan
Compile available data and/or conduct new habitat analyses to determine if instream cover is lacking in the San Joaquin River, and add instream cover as necessary.	NMFS, 'USFWS, CDFW	NMFS Recovery Plan
'Implement studies designed to quantify the impact of predation on steelhead in the San Joaquin River and identify specific locations where predation is a problem.	NMFS, USFWS, Reclamation, CDFW, DWR	NMFS Recovery Plan
Conduct studies to evaluate whether predator control actions (e.g., fishery management or directed removal programs) can be effective at minimizing predation on steelhead and spring-run Chinook salmon in the San Joaquin River; continue implementation if effective.	NMFS, USFWS, Reclamation, CDFW, DWR	NMFS Recovery Plan
Implement habitat enhancement or augmentation actions designed to minimize predation on steelhead in the San Joaquin River.	NMFS, USFWS, Reclamation, CDFW, DWR, Various NGOs	NMFS Recovery Plan
Develop and implement design criteria and projects to minimize predation at weirs, diversion dams, and related structures in the San Joaquin River.	NMFS, USFWS, Reclamation, Corps, CDFW, DWR	NMFS Recovery Plan
Monitor and evaluate the sport fishing regulations for the San Joaquin River to ensure they are consistent with the recovery of steelhead and spring-run Chinook salmon, and work with the Fish and Game Commission to modify the regulations as needed.	NMFS, CDFW	NMFS Recovery Plan
Develop information to better understand the interaction between surface water and groundwater in the San Joaquin watershed in order to evaluate the potential impacts of water management options (e.g., groundwater sales; conjunctive use) in the watershed on San Joaquin River flows.	NMFS, USFWS, Reclamation, Corps, CDFW, DWR	NMFS Recovery Plan

Develop information to better understand the potential impact of inter basin water management (i.e., Sacramento River water being pumped into and then running off the San Joaquin basin) on the migratory cues and fish response (e.g., straying) for returning adult Chinook salmon and steelhead.	NMFS, USFWS, Reclamation, Corps, CDFW, DWR	NMFS Recovery Plan
Develop an incentive-based entrainment monitoring program in the San Joaquin River designed to work cooperatively with diverters to develop projects or actions in order to minimize pumping impacts.	NMFS, USFWS, Reclamation, Corps, CDFW, DWR	NMFS Recovery Plan
Coordinate with CDFG and others and acquire water from willing sellers consistent with applicable guidelines as needed to implement a flow schedule that improves conditions for all life stages of San Joaquin chinook salmon migrating through, or rearing in, the lower San Joaquin River.	River and tributary water managers and diverters, CDFW, SWRCB, USFWS, USBR	Final Restoration Plan (USFWS 2001)
Develop an equitable, integrated San Joaquin Basin plan that will meet outflow:export objectives identified under Sacramento-San Joaquin Delta Operational Target 4 and Supplemental Actions Requiring Water 7, 8, and 9.	River and tributary water managers and diverters, CDFW, SWRCB, CDWR, USFWS, USBR	Final Restoration Plan (USFWS 2001)
Reduce or eliminate entrainment of juvenile chinook salmon at Banta-Carbona, West Stanislaus, Patterson, and El Soyo diversions by implementing the Anadromous Fish Screen Program in conjunction with other programs.	Diverters, USFWS, USBR, NMFS, CDFW, CDWR	Final Restoration Plan (USFWS 2001)
Reduce or eliminate entrainment of juvenile chinook salmon at smaller riparian pumps and diversions on the mainstem San Joaquin River.	Diverters, USFWS, USBR, NMFS, CDFW, CDWR	Final Restoration Plan (USFWS 2001)
Maintain the 6 mg/L dissolved oxygen standard during September through November in the San Joaquin River between Turner Cut and Stockton, as described in the SWRCB=s 1995 Water Quality Control Plan.	CDFW, CDWR, COE, City of Stockton, Port of Stockton	Final Restoration Plan (USFWS 2001)
Establish a basin-wide conjunctive water use program.	River and tributary water managers and diverters, CDFW, CDWR, USBR, USFWS	Final Restoration Plan (USFWS 2001)
Identify and implement actions to improve watershed management to restore and protect instream and riparian habitat.	Landowners, CDFW	Final Restoration Plan (USFWS 2001)
Identify and implement actions to maintain suitable water temperatures or minimize length of exposure to unsuitable water temperatures for all life stages of chinook salmon in the San Joaquin River and Delta.	River and tributary water managers and diverters, CDFW, USFWS, USBR	Final Restoration Plan (USFWS 2001)
Identify and implement actions to reduce predation on juvenile chinook salmon.	CDFW, USFWS	Final Restoration Plan (USFWS 2001)
Identify and attempt to maintain adequate flows for migration, spawning, incubation and rearing of white sturgeon and green sturgeon from February to May, consistent with actions to protect chinook salmon and steelhead and when hydrologic conditions are adequate to minimize adverse effects to water supply operations.	River and tributary water managers and diverters, CDFW, CDWR	Final Restoration Plan (USFWS 2001)
Identify and attempt to implement actions that will maintain mean daily water temperatures between 61°F and 65°F for at least one month from April 1 to June 30 for American shad, consistent with actions to protect chinook	CDFW, USFWS, USBR	Final Restoration Plan (USFWS 2001)

salmon and steelhead and when hydrologic conditions are adequate to minimize adverse effects to water supply operations.		
Evaluate the potential to develop and implement a strategy of coordinating a variety of specific actions, such as coincident pulse flows on San Joaquin tributaries, reduced Delta exports, hatchery releases, and gravel cleaning to stimulate outmigration and reduce predation and entrainment	River and tributary water managers and diverters, CDFW, USFWS, USBR	Final Restoration Plan (USFWS 2001)
Identify, evaluate the need for, and, if needed, attempt to maintain adequate flows for migration of steelhead, consistent with efforts to maintain adequate flows for chinook salmon.	River and tributary water managers and diverters, CDFW, USFWS, USBR	Final Restoration Plan (USFWS 2001)